

REGIONAL COMPETITION - ROUND 15

TOSS-UP

1. GENR; Multiple Choice: Diesel engines differ from gasoline engines in that they:
- a) Fire at a constant volume
 - b) Fire at a constant pressure
 - c) Fire only at top dead center
 - d) Fire only per crankshaft revolution

ANSWER: B--FIRE AT A CONSTANT PRESSURE

BONUS

1. GENR; Multiple Choice: What is the primary function of a resistor?
- a) To store an electric charge.
 - b) To store a magnetic field.
 - c) To match a high impedance source to a low impedance load.
 - d) To limit the current in an electric circuit.

ANSWER: D--TO LIMIT THE CURRENT IN AN ELECTRIC CIRCUIT

TOSS-UP

2. PHYS; Multiple Choice: A vertical spring stretches by 0.05 m when a 0.1 kg mass is attached. Determine the force constant of the spring.
- a) 0.196 N/m (Newtons per meter)
 - b) 1.96 N/m
 - c) 19.6 N/m
 - d) 196 N/m

ANSWER: C--19.6 N/M

BONUS

2. PHYS; Multiple Choice: A nail being hammered into wood produces thermal energy. At the atomic level, this energy is described as:
- a) gravitational energy
 - b) kinetic energy
 - c) chemical energy
 - d) molecular energy

ANSWER: B--KINETIC ENERGY

TOSS-UP

3. BIOL; Multiple Choice: A plant structure which consists of a single cell is a
- a) lenticel
 - b) root hair
 - c) stomate
 - d) terminal bud

ANSWER: B--ROOT HAIR

BONUS

3. BIOL; Multiple Choice: A monocotyledonous plant that is used for food by man is the
- a) bean
 - b) potato
 - c) corn
 - d) tomato

ANSWER: C--CORN

TOSS-UP

4. ASTR; Short Answer: The Barringer Meteor Crater is located in what state in the United States?

ANSWER: ARIZONA

BONUS

4. ASTR; Short Answer: assuming no close encounters with planets, the shape of the orbit of an asteroid around the sun is best described as an:

ANSWER: ELLIPSE

TOSS-UP

5. CHEM; Short answer: What element was found on the sun before it was discovered on earth?

ANSWER: HELIUM

BONUS

5. CHEM; Multiple Choice: Silver chloride is only slightly soluble in water. What effect, if any, will the addition of the salt, potassium chloride, have on a silver chloride precipitate? Will it:
- a) form a complex ion containing potassium
 - b) increase silver chloride solubility
 - c) decrease silver chloride solubility
 - d) have no effect on silver chloride solubility

ANSWER: C--DECREASE SILVER CHLORIDE SOLUBILITY

TOSS-UP

6. COMP; Multiple Choice: What is the decimal number represented by the hexadecimal number 9F?
- a) 158
 - b) 174
 - c) 159
 - d) 144

ANSWER: C--159

BONUS

6. COMP; Short Answer: What is the largest number, in decimal, that can be represented with four bit binary representation?

ANSWER: 15

TOSS-UP

7. BIOL; Short Answer: The scientist who originated and developed the system of classifying plants and animals of the earth was:

ANSWER: LINNAEUS

BONUS

7. BIOL; Multiple Choice: Protoplasmic streaming may best be observed in:
- a) amoeba
 - b) onion skin cells
 - c) cheek cells
 - d) striated muscle

ANSWER: A--AMOEBA

TOSS-UP

8. PHYS; Short Answer: Name the four primary states of matter.

ANSWER: GAS, LIQUID, SOLID, AND PLASMA

BONUS

8. PHYS; Short Answer: What is the smallest pattern unit of the arrangement of atoms in a crystal from which the whole crystal can be built up by translating the unit parallel to itself in the direction of its edges called?

ANSWER: A (PRIMITIVE) UNIT CELL

TOSS-UP

9. ERSC; Multiple Choice: Ice sheets from the most recent episode of continental glaciation receded about:
- a) 2 million years ago
 - b) the start of the Pleistocene Epoch
 - c) 11,000 years ago
 - d) they are actually still slowly advancing

ANSWER: C--11,000 YEARS AGO

BONUS

9. ERSC; Multiple Choice: Most detrital sedimentary rocks (e.g., sandstones and shales)
- a) form on land above sea level
 - b) form as accumulations under a column of water
 - c) precipitate from saturated ground water
 - d) are accumulations of plant and animal debris

ANSWER: B--FORM AS ACCUMULATIONS UNDER A COLUMN OF WATER

TOSS-UP

10. CHEM; Short Answer: In 1947, John Bardeen, Walter Brattain, and William Shockley of Bell Laboratories produced the first crude transistor. What semiconducting element was used in this first transistor?

ANSWER: GERMANIUM

BONUS

10. CHEM; Multiple Choice: One-molar aqueous solutions of the salts, sodium acetate and potassium carbonate have values that are:
- a) equal to 7
 - b) less than 7
 - c) greater than 7
 - d) greater than 7 for the carbonate but less than 7 for the acetate

ANSWER: C--GREATER THAN 7

TOSS-UP

11. BIOL; Multiple Choice: Of the following, the plant hormone concerned with growth is
- a) auxin
 - b) estrogen
 - c) testosterone
 - d) ATP

ANSWER: A--AUXIN

BONUS

11. BIOL; Multiple Choice: Acromegaly is directly caused by malfunction of the
- a) thyroid gland
 - b) pituitary gland
 - c) parathyroid gland
 - d) adrenal gland

ANSWER: B--PITUITARY

TOSS-UP

12. CHEM; Short Answer: In 1940, which naturally occurring isotope was used to produce the first synthetic isotope?

ANSWER: URANIUM-238

BONUS

12. CHEM; Multiple Choice: Which of the following nuclides is most likely to decay by positron emission?
- a) Copper 59
 - b) Copper 63
 - c) Copper 67
 - d) Copper 68

ANSWER: A--COPPER 59

TOSS-UP

13. MATH; Short Answer: Let an urn contain two blue balls and 3 red balls. If two balls are to randomly selected with replacement, what is the probability that both balls will be blue?

ANSWER: 4/25 (ACCEPT 0.16 OR 16%)

BONUS

13. MATH; Short Answer: Let an urn contain 2 blue balls and 3 red balls. If two balls are to be randomly selected without replacement, what is the probability that both balls will be blue?

ANSWER: 1/10 (ACCEPT 0.1 OR 10%)

TOSS-UP

14. GENR; Multiple Choice: Which vegetable oil is highest in saturated fat?

- a) Palm oil
- b) Canola oil
- c) Sunflower oil
- d) Linseed oil

ANSWER: A--PALM OIL

BONUS

14. GENR; Multiple Choice: Which of the following elements is not known to be essential to living animals?

- a) Nitrogen
- b) Zinc
- c) Nickel
- d) Copper

ANSWER: C--NICKEL

TOSS-UP

15. BIOL; Multiple Choice: Sap rises in woody stems because of root pressure and
- a) transpiration pull
 - b) enzyme action
 - c) molecular adhesion
 - d) photosynthesis

ANSWER: A--TRANSPIRATION PULL

BONUS

15. BIOL; Multiple Choice: Bread mold resembles ferns in that both develop
- a) mycelia
 - b) hyphae
 - c) pinnules
 - d) spores

ANSWER: D--SPORES

TOSS-UP

16. ASTR; Multiple Choice: The Astronomical Unit is a unit of measure used by astronomers. Which of the following numbers would best approximate this distance?
- a) 160 million kilometers
 - b) 100 million kilometers
 - c) 150 million kilometers
 - d) 125 million kilometers

ANSWER: A--150 MILLION KILOMETERS

BONUS

16. ASTR; Short Answer: According to data from the Hubble Space Telescope, the proposed boundary between the solar system and interstellar space is a distance of 100 Astronomical Units from the sun. What name is given to this boundary?

ANSWER: HELIOPAUSE

TOSS-UP

17. PHYS; Short Answer: In thermodynamics, walls/surfaces that do not allow the transfer of energy as heat are called:

ANSWER: ADIABATIC

BONUS

17. PHYS; Short Answer: In thermodynamics, walls/surfaces that permit energy transfer as heat are called?

ANSWER: DIATHERMIC

TOSS-UP

18. CHEM; Short answer: Hydrazine is related to ammonia by the substitution of an amide group for a hydrogen atom. What is the chemical formula for hydrazine?

ANSWER: $\text{H}_2\text{N} - \text{NH}_2$ (N_2H_4) (ACCEPT $\text{NH}_2 - \text{NH}_2$)

BONUS

18. CHEM; Multiple Choice: Describe what happens when sulfur dioxide dissolves in water.
- a) Sulfur dioxide is insoluble in water
 - b) A solution of sulfurous acid is formed
 - c) A solution of sulfuric acid is formed
 - d) Sulfur trioxide is formed

ANSWER: B--A SOLUTION OF SULFUROUS ACID IS FORMED

TOSS-UP

19. ERSC; Multiple Choice: The most common rock type comprising the Earth's oceanic crust is:
- a) granite
 - b) limestone
 - c) oceanic oozes
 - d) basalt

ANSWER: D--BASALT

BONUS

19. ERSC; Multiple Choice: The oldest rocks recovered from the Earth's oceanic crust are of what age:
- a) Jurassic
 - b) Cambrian
 - c) Archean
 - d) Holocene

ANSWER: A--JURASSIC

TOSS-UP

20. COMP; Multiple Choice: Which of the following does not belong?
- a) PASCAL
 - b) ALGOL-W
 - c) MODULA-2
 - d) ADA

ANSWER: D--ADA (THE OTHERS WERE INVENTED BY DR. NIKLAUS WIRTH)

BONUS

20. COMP; Short Answer: What is the decimal number represented by the following binary number: 01101?

ANSWER: THIRTEEN (13)

TOSS-UP

21. BIOL; Multiple Choice: Stored food for the embryo of a bean seed is found in the
- a) plumuli
 - b) hypocotyl
 - c) cotyledons
 - d) testa

ANSWER: C--COTYLEDONS

BONUS

21. BIOL; Multiple Choice: The specific function of light energy in the process of photosynthesis is to:
- a) activate chlorophyll
 - b) split water
 - c) reduce carbon dioxide
 - d) synthesize glucose

ANSWER: A--ACTIVATE CHLOROPHYLL

TOSS-UP

22. MATH; Short Answer: If the average of three numbers is 10, what does the average become if we include the number 2?

ANSWER: EIGHT (8)

BONUS

22. MATH; Short Answer: If the average of three numbers is 10, what does the average become if we include the numbers 2 and 3?

ANSWER: SEVEN (7)

TOSS-UP

23. PHYS; Short Answer: A quantum of energy in electromagnetic radiation is known as the "photon", what is the quantum of energy of a lattice vibration called?

ANSWER: PHONON

BONUS

23. PHYS; Short Answer: The energy difference between the lowest point of the conduction band and the highest point of the valence band is called?

ANSWER: THE "BAND GAP"

TOSS-UP

24. CHEM; Multiple Choice: Spectroscopies provide information on atomic, molecular and structural composition of matter. Which of the following spectroscopies provides information on quantized molecular transitions?

- a) Positron Emission Spectroscopy
- b) X-ray Photoelectron Spectroscopy
- c) Mossbauer Spectroscopy
- d) Ultraviolet Spectroscopy

ANSWER: D--ULTRAVIOLET SPECTROSCOPY

BONUS

24. CHEM; Multiple Choice: The phenomenon called photo-electron spectroscopy is related to its name because:

- a) the spectra are photographs of the electron traces left in a cloud chamber
- b) because photons are given off upon electron capture
- c) because electrons are given off in the process of photon adsorption
- d) is made possible by the recent noble prize winning work on the photoelectron particle

ANSWER: C--BECAUSE ELECTRONS ARE GIVEN OFF IN THE PROCESS OF PHOTON ADSORPTION

TOSS-UP

25. PHYS; Multiple Choice: What altitude has less air resistance for airplanes to fly at?
- a) 100 feet
 - b) 5,000 feet
 - c) 35,000 feet
 - d) 80,000 feet

ANSWER: D--80,000 FEET

BONUS

25. PHYS; Short Answer: If the valence electrons exactly fill one or more bands, leaving others empty, the crystal is called an?

ANSWER: AN INSULATOR
